

Date: March 31, 2008

**Scope of Work for
Philpott Dam 216 Feasibility Study
Natural and Cultural Resources
Flow Management (Ramping) Monitoring
Description of Existing
And
Future Without Project Conditions**

1. Introduction: The U.S Army Corps of Engineers, Wilmington District (Wilmington District) in partnership with the Commonwealth of Virginia are sponsoring a feasibility study under the authority of Section 216 of the River and Harbor and Flood Control Act of 1970 (Public Law 91-611). Section 216 authorizes the review of the operation of the Philpott Dam and Lake and report recommendations to Congress on the advisability of modifying the structures or the structures' operation and for improving the quality of the environment in the overall public interest. Approval of participation in this feasibility study by the US Army Corps of Engineers, Wilmington District, was based on the report entitled 905(b) Reconnaissance Report, Philpott Dam and Lake, Virginia, (Section 216) Study, Smith River dated August 2004, approved 7 January 2005. Public, stakeholder, and local, State, and Federal agency input received during the early stages of this study indicated there is a public interest in reviewing the following areas: natural resources; downstream fisheries management related to the brown trout fishery, water quality, the Philpott guide curve and its effects on various resources, and upstream fisheries related to the largemouth bass fishery in Philpott Lake. Hydropower and upstream recreation were topics addressed in several comment letters. Downstream water supply, recreation, erosion and siltation, drought management, fish and wildlife, endangered species, cultural resources, and shoreline management are of concern; however, very few comments were submitted regarding these concerns. US Army Corps of Engineers Regulation (ER) 1105-2-100, Planning Guidance Notebook, provides full guidance regarding conduct of the study. Technical Work Groups were formed in the following areas: Natural and Cultural Resources; Operation Policies and Administrative Procedures; Shoreline Management and Erosion; Water Quality; Water Supply; and, Aesthetics and Recreation. Each of the Work Groups is to develop a Scope of Work to assess existing conditions and to forecast the future conditions that would exist if no modifications are made to operating procedures at the Philpott Dam. This analysis is being done in accordance with U.S. Water Resources Council's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* as implemented by the U.S. Army Corps of Engineers' Planning Guidance Note Book (Engineering Regulation 1105-2-100). A summary of the progress made thus far on the Philpott 216 Study can be found in the November 2006 *Project Management Plan for Philpott Lake, Virginia (Section 216) Feasibility Study*. This management plan and other materials regarding the Philpott 216 study are available at the following website:

http://www.saw.usace.army.mil/Authorized_Protocols/Main.htm.

5. Purpose: The study entitled “*Influences of Fluctuating Releases on Stream Fishes and Habitat in the Smith River, below Philpott Dam*”, conducted by Orth et.al. (2004) indicated that the rapid increase in flows on the Smith River during generation from Philpott Dam causes substantial increase in the shear stresses on the channel bed. The hydraulic modeling showed that gravels, which are important to redd construction, may be moved within the initial release period. This fluctuating flow also causes a higher stress to fish, may displace young brown trout, and prohibits successful spawning by minnows and darters (including the Roanoke logperch). The study recommended using a two-step flow release scenario. The study illustrated that the shear stress acting on gravel and drag force exerted on fish may be greatly reduced under such a hypothetical reservoir release scenario, and hence a healthier stream can be maintained without affecting power generation requirement. This recommendation was accepted by the USACE and Dominion Power and was implemented in 2006 (?).

The objective of the proposed study is to evaluate how the current generator ramping scenario of starting one turbine one hour before the second turbine and stopping one turbine one hour before the second turbine is impacting the fisheries resources of the Smith River below Philpott Dam. Specific flow management issues identified by the Natural Resources Work Group are:

- Is there a better ramping scenario then the one currently being used? The general consensus of the work group was that the current ramping scenario is the best available given the turbines in use at this time.
- There should be a review of new turbine technology so that when the turbines in Philpott Dam need to be replaced, turbines capable of providing improved flow conditions (such as variable flow) in the Smith River are identified and selected.
- The study conducted by Orth et.al. (2004) determined that the optimal flow release range for the Smith River was from 9-12 m³/s (317-423 f³/s). The work group determined that the development of new flow alternatives based on water availability that would benefit aquatic life and still satisfy other uses (flood control and hydropower) would be developed in Phase 3 of the study.

Information gathered during the course of this study, will be used to determine if the current ramping scenario is benefiting aquatic life in the Smith River.

6. Background: Considerable fisheries research has been conducted on the Smith River during the past 25 years by the Virginia Department of Game and Inland Fisheries (VDGIF) and Virginia Polytechnic Institute and State University (Virginia Tech). VDGIF and Virginia Tech cooperated on a five year study of the fisheries resources of the Smith River from September 1999 to June 2004. The study was entitled “*Influences of Fluctuating Releases on Stream Fishes and Habitat in the Smith River, below Philpott Dam*”. The primary purpose of the research (Orth et al. 2004) was to validate and discover new fish-population and habitat relationships and provide defensible fish-habitat relationships to be used for developing specific management actions to improve the fisheries resources of the Smith River tailwater. More specific objectives of the study are listed below:

- To characterize the instream habitat conditions in areas where successful spawning and juvenile rearing of brown trout occurs.
- To collect biological data to quantify abundance of trout and nongame fishes in the Smith River from Philpott Dam to Martinsville, quantify temperature limits of fish occurrence and monitor annual variation in brown trout recruitment success.
- To evaluate the bioenergetic constraints on growth under existing temperature regimes.
- To design a field survey and modeling protocol to measure effects of varying flows on the shear stress, mobilization of streambed gravels, and relate discharge to the amount of redd scouring or brown trout fry displacement that would occur at sites in the tailwater.

The ***Flow Management*** section of the Executive Summary of the Virginia Tech/VDGIF Study is inserted below to provide general insight into the Smith River flow management issues and study results.

Influences of Fluctuating Releases on Stream Fishes and Habitat in the Smith River, below Philpott Dam.

EXECUTIVE SUMMARY

Flow Management -- Hydraulic models were used in predicting physical habitat for brown trout spawning under alternative flow scenarios. Results from the habitat simulation indicates a significantly positive relationship between redd density and habitat quality predicated by the model. Based on our regression analysis, current base flow appears to be below the optimal reservoir release range (9-15 m³/s), while the peak flow is too high to support suitable brown trout spawning environment. A 12 m³/s reservoir release scenario predicted the best suitable habitat availability in our study site. However, because the highly fluctuating flow causes temporal changes in the locations of suitable habitat, an adaptive monitoring program is needed to correctly evaluate the fish habitat under such a flow scenario. Because brown trout spawning is predictable based on daily temperatures, we recommend that peaking flows be restricted during the time of peak spawning. Furthermore, we identified a significant response of brown trout to frequency and magnitude of peaking flows during the incubation and emergence, which indicates that peaking operations could be restricted during these times, especially in dry years, in order to enhance brown trout recruitment success.

The rapid increase in flows during generation causes substantial increase in the shear stresses on the channel bed. Our analysis from hydraulic models shows that gravels, which are important to redd construction, may be moved within the initial release period. This fluctuating flow also causes a higher stress to fish, may displace young brown trout, and prohibits successful spawning by minnows. Our recommendation is to use a two-step flow release scenario. It is better to use one turbine to release flow for half an hour and then add another turbine to release additional flow if necessary. Study illustrates the shear stress acting on gravel and drag force exerted on fish may be greatly reduced under such

a hypothetical reservoir release scenario, and hence a healthier stream can be maintained without affecting power generation requirement.

7.0 Technical Services: This scope of work requests services related to objectives described in Section 5 and 6 (Purpose and Background).

7.1 Determination of Current Ramping Scenario Benefits on Fisheries Resources

(Task1): The study will be conducted by the Virginia Department of Game and Inland Fisheries and will include fish population samples (electrofishing) at a minimum of six sites on the Smith River below Philpott Dam on an annual basis from 2007-2010. Data to be collected will include species composition and relative abundance and this data will be compared annually to historical sample data (pre-ramping) to determine if the fisheries resources are improving under the current ramping scenario.

8. Timeline: The timeline **indicated** for each task of this project is *based on timing of previous similar projects. However as indicated in Section 13, proposals that provide justification for an accelerated schedule by using adaptive management or other techniques will be given a higher ranking.*

SCHEDULE, FUNDING AND METHOD OF ACCOMPLISHMENT

Task	Schedule	Estimated Cost	Method of Accomplishment
Task 1. Determination of Current Ramping Scenario Benefits of Fisheries Resources	Scheduled Completion - 2010	2007 - \$9,000 2008 - \$9,450 2009 - \$10,400 2010 - \$11,400 Total = \$40,250	VDGIF - Work In Kind

Funding will be provided by VDGIF and the Commonwealth of Virginia as work in kind. Costs are task completion estimates and fiscal year costs will need to be adjusted depending on changes in survey costs.

Literature Cited

Orth, D. J., T. J. Newcomb, P. Diplas, and C. A. Dolloff. 2004. Influences of fluctuating releases on stream habitats for brown trout in the Smith River below Philpott Dam. Final report, Federal Aid for Sport Fish Restoration. Contract 08220203. Virginia Department of Game and Inland Fisheries, Richmond, VA . 284 pp.